

Where To Get Coffee On Campus?



Presented by Group 5

Aimee Woszack, Ali Asad, Irteza Haider, Ru Lan Luo, Shirley Ching

Introduction

- The bigger picture: Comparing average wait times at Tim Hortons, Starbucks and second cup. Comparing certain aspects of the demographic of people who visit these chains, mainly gender.
- Questions of interest: Which of these 3 major coffee shops on campus has the lowest average wait times? Could any of these shops benefit from implementing gender specific advertising?
- Target population: People who go to UTM



Method

- **Three separate experiments!**
- **Sampling technique used:** Stratified random sampling. Each time frame of 1 hour (10 AM, 12 PM, 2 PM, 4 PM and 6 PM) is a stratum.
- **Pilot Study:** We took ~15 observations per stratum to calculate the sample variance for each stratum and then use it to find required sample size.
- **Big N:** We used the UTM fact sheet and a survey conducted in 2016 showing the amount of Canadians that have visited the three coffee shops to approximate our N_i 's.



Summary of Our Data: \bar{y} In General

	$\bar{y}_{\text{second_cup}}$	$V(\bar{y}_{\text{second_cup}})$	$\bar{y}_{\text{starbucks}}$	$V(\bar{y}_{\text{starbucks}})$	$\bar{y}_{\text{tim_hortons}}$	$V(\bar{y}_{\text{tim_hortons}})$
10 AM	0:23	0:41	3:56	13:11	6:33	36:04
12 PM	0:58	14:53	4:56	13:52	5:36	54:59
2 PM	0:40	4:29	3:33	10:57	5:36	35:23
4 PM	1:12	5:53	3:50	25:44	7:49	39:18
6 PM	-	-	4:22	11:28	1:53	10:20
$\bar{Y}_{\text{st}}, V(\bar{Y}_{\text{st}})$	0:48	0:12	4:03	0:21	5:29	1:10

Using $\theta \pm 2\sqrt{V(\theta)}$, we can create confidence intervals...(we chose .95 by default)

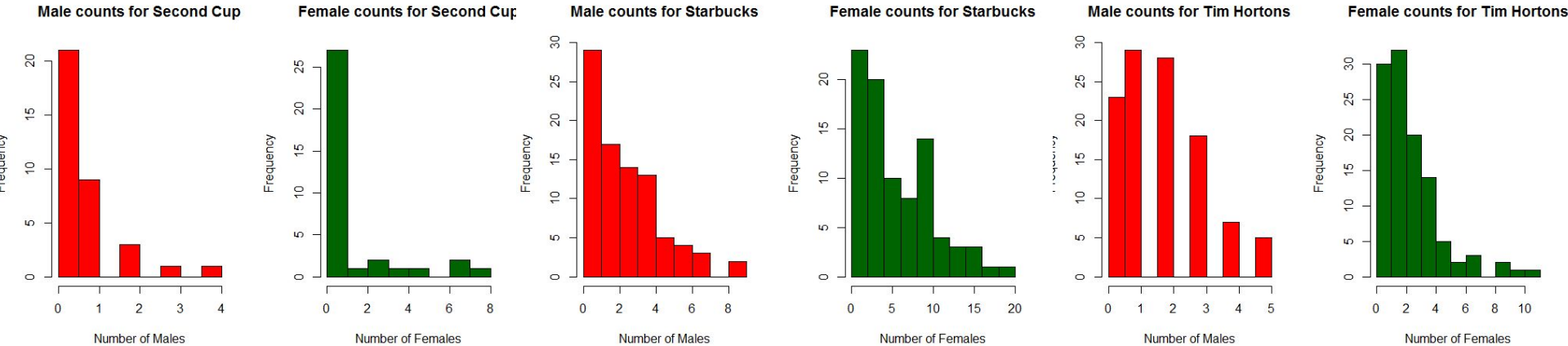
Summary of Our Data: 95% CI For \bar{y}_{st}

$\bar{y} \pm 2\sqrt{V(\bar{y})}$	\bar{y}_{st}	Lower Confidence Limit	Upper Confidence Limit
Second Cup	0:48	0:42	0:56
Starbucks	4:03	3:54	4:13
Tim Hortons	5:29	5:13	5:46

Example of possible interpretation: *We are 95% confident that for 10 or less customers lined up, the mean wait time is between [LCL] and [UCL] for this particular coffee chain on campus.*



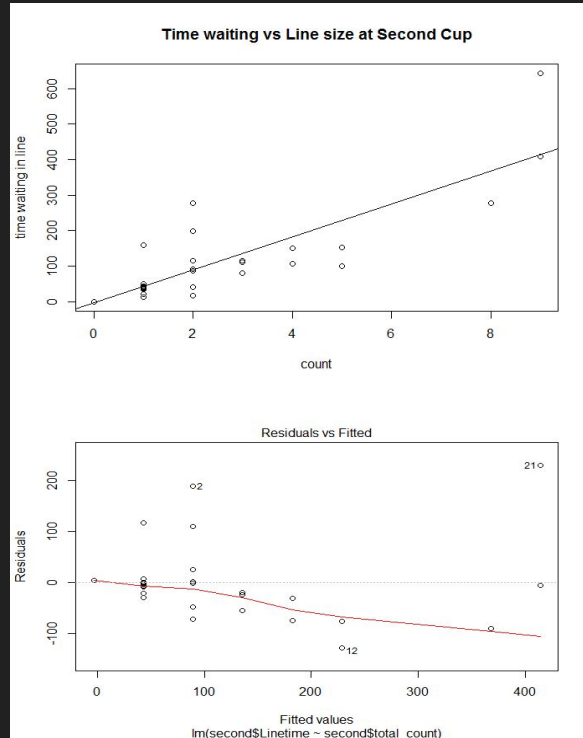
Proportion of Females vs. Males Customers (Gender Assumed)



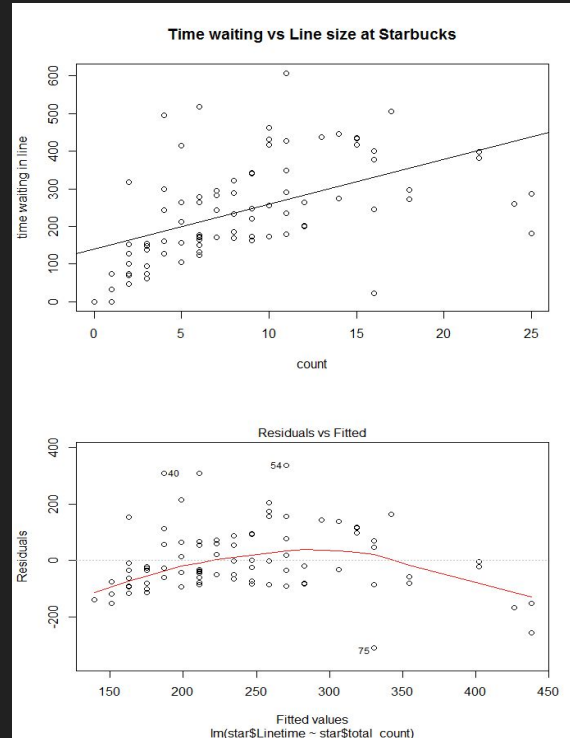
	Proportion of females	Proportion of males
Second Cup	0.7142857	0.2857143
Starbucks	0.6880857	0.3119143
Tim Hortons	0.6041237	0.3958763

In general, all three chains seem to serve more female customers than males...

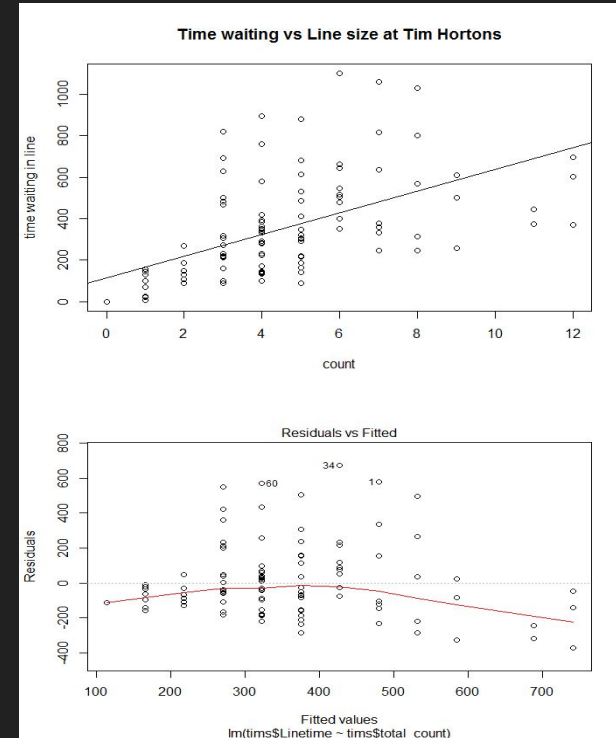
Statistical Method: Regression



Residual standard error: 70.55 (33 DF)
Multiple R-squared: 0.7278
Adjusted R-squared: 0.7195
F-statistic: 88.22 (1 and 33 DF)
p-value: 7.595e-11



Residual standard error: 118.2 (85 DF)
Multiple R-squared: 0.2651
Adjusted R-squared: 0.2565
F-statistic: 30.67 (1 and 85 DF)
p-value: 3.348e-07



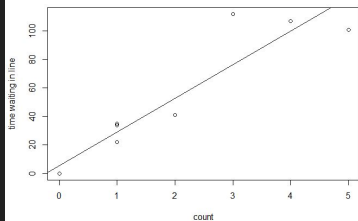
Residual standard error: 209.4 (108 DF)
Multiple R-squared: 0.3134
Adjusted R-squared: 0.3071
F-statistic: 49.3 (1 and 108 DF)
p-value: 2.037e-10

Time Waiting vs. Line Size Within Hours

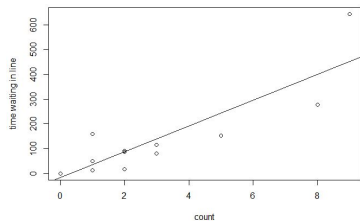
Second Cup (10am, 12pm, 2pm, 4pm)



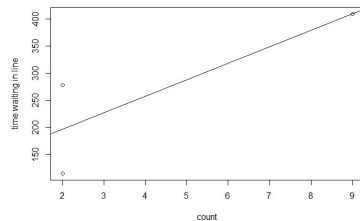
Time waiting vs Line size at Second Cup at 10



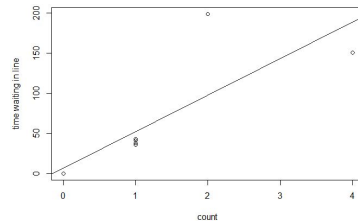
Time waiting vs Line size at Second Cup at 12



Time waiting vs Line size at Second Cup at 2

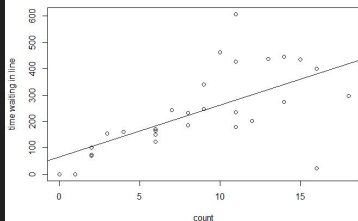


Time waiting vs Line size at Second Cup at 4

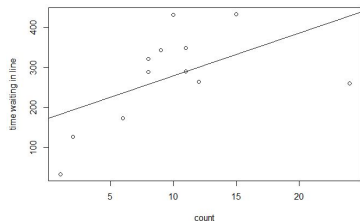


Starbucks (10am, 12pm, 2pm, 4pm, 6pm)

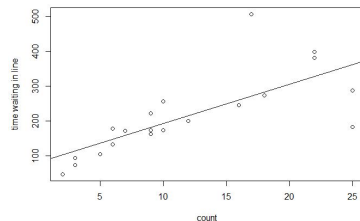
Time waiting vs Line size at Starbucks at 10



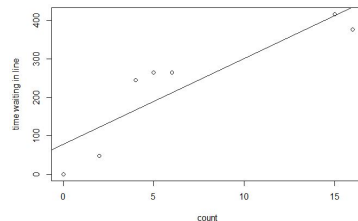
Time waiting vs Line size at Starbucks at 12



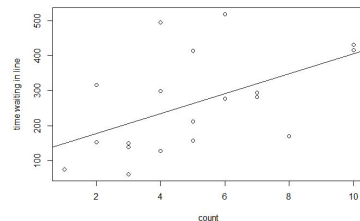
Time waiting vs Line size at Starbucks at 2



Time waiting vs Line size at Starbucks at 4

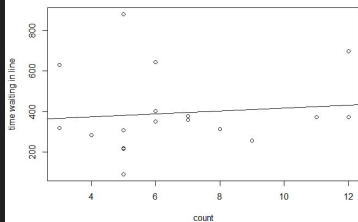


Time waiting vs Line size at Starbucks at 6

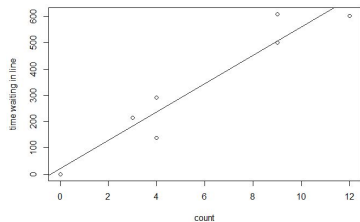


Tim Hortons (10am, 12pm, 2pm, 4pm, 6pm)

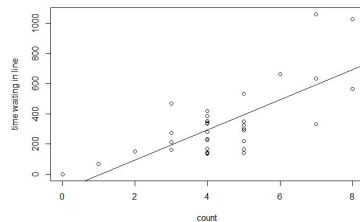
Time waiting vs Line size at Tim Hortons at 10



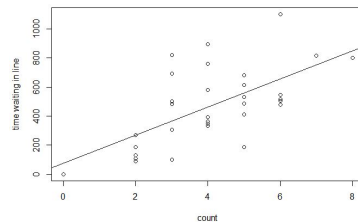
Time waiting vs Line size at Tim Hortons at 12



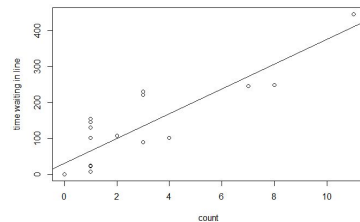
Time waiting vs Line size at Tim Hortons at 2



Time waiting vs Line size at Tim Hortons at 4



Time waiting vs Line size at Tim Hortons at 6



Our Issues...And Our Solutions

Potential sources of errors:

- Approximating true population size N
- Only interest in 10th person or less' wait time; can't say anything beyond that
- Limited number of days. Sample size could've been bigger
- Wait times are **not** the actual times until we receive our order
- People leaving the line in the middle of measuring
- Human errors (reaction time or making errors in count)
- Malfunctions (broken card reader at starbucks)
- Other (training new employees)

Methods of Improvement:

- Multiple people counting to eliminate human error of overlap of timing
- Carry out study on a larger scale
- Observe for a longer time (to find wait time until our order is received)



Conclusions

- Our question: Where's the lowest average wait time?
- **Best answer:** Go to Second Cup, ideally around 10 AM
 - Yes, it's early! But! You will only wait for a couple of seconds!
- **Worst answer:** Go to Tims, especially around 10 AM and 4 PM.
 - Why would you wait 6-7 minutes *just* to get served?
Why would you do this to yourself?



We also hope that our findings will provide us with insights into customers' preferences that we can share with these chains to optimize their service to increase their profits as well.

References Used



FACT SHEET | UNIVERSITY OF TORONTO MISSISSAUGA

Website

In-text: ("Fact Sheet | University Of Toronto Mississauga")

Your Bibliography: "Fact Sheet | University Of Toronto Mississauga", *Utm.Utoronto.Ca*, 2018,
<https://www.utm.utoronto.ca/about-us/fact-sheet>. Accessed 27 Nov 2018.



SHARE OF CANADIANS BY COFFEE SHOPS VISITED 2016 | STATISTIC

Website

In-text: ("Share Of Canadians By Coffee Shops Visited 2016 | Statistic")

Your Bibliography: "Share Of Canadians By Coffee Shops Visited 2016 | Statistic", *Statista*, 2018,
<https://www.statista.com/statistics/575463/share-of-canadians-by-coffee-shops-visited/>. Accessed 27 Nov 2018.